DETAILS OF THE WEATHER IN THE UNITED STATES, JUNE, 1919.

CYCLONES AND ANTICYCLONES.

By A. J. HENRY.

The usual method of classifying cyclones and anticyclones according to place of origin or first appearance on the daily weather map has little significance when applied to the current month. Practically all of the cyclones of the month first appeared in the Canadian northwest as weak disturbances or more generally as a trough of low pressure that stretched from the Gulf of California to the Canadian border. This trough was more or less a permanent feature of the month, and explains in part the unusual dryness and the high temperatures experienced in the region west of the Rockies. Each individual disturbance that advanced from the west seemed to merge with the existing trough and to completely lose its identity therein. Possibly this sequence of events was a result of the movement of anticyclones along the northern border of the United States, and to the fact that on reaching the Lake region and the Saint Lawrence Valley there was a tendency for them to increase somewhat in intensity and to move less rapidly. In any event it seems reasonable to couple the failure of the trough of low pressure west of the Rockies to break up with the persistency of high pressure in northeastern districts of the United States and Canada.

THE WEATHER ELEMENTS.

By P. C. DAY, Climatologist and Chief of Division.

[Dated: Weather Bureau, Washington, August 1, 1919.]

PRESSURE AND WINDS.

The distribution of the mean atmospheric pressure over the United States and Canada, and the prevailing direction of the winds for June, 1919, are graphically shown on Chart VII, while the means at the several stations, with the departures from the normal, are shown in Tables I and III.

The month opened with high pressure in the far Northwest which during the following few days advanced into the Mountain and Great Plains regions and thence to the Great Lakes and lower St. Lawrence Valley. Another high pressure area began to develop over the eastern Canadian Provinces about the 7th and during the following few days dominated the North Atlantic coast, the pressure becoming unusually high in the far Northeast about the end of the first decade. Before pressure in these districts had returned to normal, another HIGH had moved eastward over the Great Lakes, and, merging with that just mentioned, caused an unusual persistence of pressure above normal over much of the eastern part of the country. During the latter half of the month pressure remained near the normal until toward the close when another HIGH moved southward to the Great Lakes and thence eastward to the middle Atlantic coast where it persisted at the end.

The month was marked by an unusual absence of well-defined low-pressure areas having a distinctive progressive movement, although pressure was moderately low in central and southern districts during much of the first decade, and over the Lake region near the middle of the last decade.

The average pressure for the month was above the normal in all portions of the country, except locally in the central Plateau region, the far Southwest and over the Florida Peninsula, where it was slightly below. In the region of the Great Lakes and to the eastward and southeastward the departures above the average were large, considering the period of the year.

The distribution of atmospheric pressure was not favorable for the development of high winds over any considerable areas, and such storms as were reported were distinctly local and were in the main associated with thunderstorms. Only in a few instances were velocities as great as 50 miles an hour recorded and these were at widely separated points. The persistence of high pressure in the Lake region and Northeast favored the usual trend of anticyclonic winds, and their directions were mainly from easterly courses over the east Gulf and South Atlantic States, and from southeast to south in the West Gulf, Central Valleys and Plains region. West of the Rockies the usual diversity of direction prevailed, although near the coast they were mainly from the northwest.

TEMPERATURE.

June opened with cool weather in the far West and by the morning of the 3d freezing temperature had occurred over much of the Middle Plateau and Rocky Mountain districts, and into the Central Plains States. The temperature at points along the eastern slopes of the Rockies during this period reached new low levels for the month of June and serious damage from frost and freezing resulted over extensive areas. During this cold period in the West more moderate conditions were the rule to the eastward, and by the middle of the first decade temperature in practically all districts had risen to normal, or above, and moderately warm weather continued during the remainder of the decade, except for a sharp cool spell during the last few days in the Northern Plateau, where heavy frosts were reported on the morning of the 7th.

Throughout the second decade temperatures were generally above the normal in the districts from the Rocky Mountains eastward, and frequently below in the States to the westward, particularly during the first few days, heavy frosts being reported from points in the Northern Plateau about the 12th. By the end of the decade, however, temperatures had risen above the normal over the greater part of the country.

During the early part of the third decade warm weather continued, the day temperatures frequently rising above 100° at points in the Northwest, and near the middle of the decade there was a decided rise in temperature over the northeastern districts. During the latter part of the month a cool area of considerable magnitude overspread the Lake region and, extending southward and eastward, brought sharp falls in temperature over the greater part of the eastern third of the country, the cool weather continuing till the end of the month over the Atlantic coast districts, light frosts being reported at exposed points from the lowlands of New Jersey to New England, on the mornings of the 29th and 30th. In most other districts the weather continued warm at the end of the month.

Maximum temperatures of 100° or higher occurred during some period of the month in practically all States of the Union, the extreme, 121°, being reported from the desert region of California, while values of 110° or slightly

higher were observed locally in the middle Plateau region. At a few points in the lower Lake region and Middle Atlantic States, the maximum temperatures on the 4th were the highest of record for June.

Minimum temperatures were below 32° at points in all the Mountain States of the West, and over much of the Great Plains from Nebraska northward, and locally in the Lake region and Northeastern States. The lowest reported, 10°, was observed in the high mountains of Utah, and readings nearly as low were reported from points as far south as central New Mexico.

For the month, as a whole, the temperature averaged higher than normal in most central and northern districts, the departures being exceptionally large for a summer month in the northern Rocky Mountain district and in the region of the Great Lakes, Ohio Valley, and adjoining sections. The month was markedly warm throughout in the Lake region, some stations reporting temperature above normal each day in the month, except the 27th and 28th, and over Michigan and portions of adjoining States the month was the warmest June in 50 years or more. While temperatures remained almost continuously above normal in the Lake region, they were as persistently below in portions of the Southwest, where at points in Texas and New Mexico the temperatures did not rise above the normal during the entire month and in some sections it appears to have been the coolest June since observations began.

PRECIPITATION.

Showery weather obtained in most central districts at the beginning of the month, but from the Ohio Valley and Middle Atlantic States northeastward, and west of the Rockies the weather was clear. During the next few days rain became general in the Gulf States, the Mississippi and lower Missouri Valleys, and the western Lake region. About the middle of the first decade showers, mostly moderate to light, were received in nearly all central and northern districts, from the Great Plains eastward, and also in portions of the South Atlantic States, and for several days following there were local rains east of the Mississippi River, except along the immediate Gulf coast and in some South Atlantic districts, and at the same time showers occurred in the central and southern Rocky Mountain sections and in most of the Great Plains. The falls were heavy in the South Atlantic States and in portions of the Lake region, the Ohio Valley, and Central Plains States. At the close of the decade there were showers in New England, the Western Gulf States and from the central and southern Plains northeastward to the Great Lakes, and in portions of Tennessee, and the adjoining States, and along the North Pacific coast.

The beginning of the second decade was marked by showers from eastern Texas, Louisiana, and western Mississippi northward to the Canadian border, and local rains were received in the Southeast and far Northwest. During the following few days unsettled, showery weather prevailed in the north-central, central, and southern districts, the rainfall being heavy in parts of North Dakota and in extreme southern Florida. About the middle of the month showers were quite general in the West Gulf States, the Lake region, and from the upper Ohio Valley and middle Atlantic coast States northeastward; the rainfall being heavy in southeastern Texas. During the latter part of the decade showers occurred in the central and southern Rocky Mountain districts and in nearly all sections between the Rockies and the Mississippi River, and also in the Lake region, Tennessee, and northern portions of the East Gulf States and in most of Florida.

Early during the third decade showery weather obtained from the Ohio Valley southward, in the West Gulf States, the central and upper Mississippi Valley, and the northern Plains. Toward the middle of the decade general rains prevailed in the western upper Lake region, the Mississippi Valley, the southern Plains, and in most localities from the Ohio Valley and West Virginia southward, the rainfall being heavy in the lower Ohio Valley and portions of Tennessee. This rainy condition extended during the next few days into the East and South with heavy falls in many portions, particularly along the middle Atlantic coast where locally 5 inches or more occurred in 24 hours. The month closed with the weather clear in all districts except over portions of the Gulf States.

For the month as a whole precipitation was copious and generally above normal from Texas and Louisiana northward to South Dakota and Minnesota, and generally over the East Gulf and South Atlantic States, the monthly falls over these areas ranging largely from 4 to 8 inches, with small sections having as high as 10 to 12 inches. In other districts east of the Rocky Mountains the precipitation was generally less than normal although its distribution through the month was such that no serious drought was reported in any district, and as a rule the amounts received were abundant for all needs. To westward of the Rocky Mountains there was practically everywhere a deficiency in the rainfall and particularly so in the more northern districts. In portions of Montana the precipitation was the least of record for June, and one of the worst droughts in the history of the State was being experienced at the end of the month. In other portions of the far West, particularly in the Great Basin region and California, the month was unusually dry, and much injury had resulted, not only in the unirrigated regions but even where irrigation is practiced, due to the low levels of the streams, caused by the general lack of the usual supply of snow in the high mountains.

RELATIVE HUMIDITY.

From the Rocky Mountains eastward to the Mississippi River the relative humidity was practically everywhere higher than the normal, the excess being unusually great in portions of Texas and eastern New Mexico and the adjoining districts to the northward. East of the Mississippi River there were no large departures either above or below the normal. West of the Rocky Mountains the general absence of moisture is reflected in the low humidity readings which were in special cases from 15 to 25 per cent less than the average. Over extensive areas between the Rocky and Sierra Mountains, the average relative humidity at noon, local time, for the entire month was less than 20 per cent and at some points scarcely more than 10 per cent. The sections having the highest humidity at noon included the Upper Lake region and the several coasts, although points in the middle Plains had relative humidity nearly as great.

SEVERE STORMS.

A severe tornado visited Fergus Falls, Minn., and vicinity June 22, 1919, during which 57 persons were reported killed, 88 injured and three and a half million dollars' worth of property destroyed. A full account of the storm will be found in another portion

of this REVIEW (see pp. 392–393). Thunderstorms were numerous but apparently not notably severe, except in a few instances. At Evansville, Ind., a severe wind and electrical storm occurred on the evening of the 2d causing great damage, the wind attaining the unusually high velocity of 150 miles per hour for a brief period. At Broken Arrow, Okla., a severe wind, rain, and hail storm occurred on the 6th causing great damage in the surrounding country (see pp. 391–392 above). At Cairo, Ill., a severe wind and hail storm on the afternoon of the 8th caused great damage to crops. Near Ionia, Iowa, about the 16th reports indicate the occurrence of a near-tornado with considerable damage over a narrow but considerably extended area; and reports from Oakland, Ill., state that a storm with tornado characteristics swept over that place on the evening of the 24th, doing considerable property damage.

Average accumulated departures for June, 1919.

Districts.	Temperature.			Precipitation.			Cloudiness.		Relative humidity.	
	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure from the normal.	General mean for the current month.	Departure from the normal.
	° F.	° F.	° F.	In.	In.	In.	0-10		P. ct.	
New England	64.6	+1.0	+14.6	2.00	−1.20	+1.50	5.0	−0.3	78	− 1
Middle Atlantic	71.3	+1.0	+14.2	3.09	−0.50	−0.40	5.1	0.0	75	− 2
South Atlantic	75.5	−0.6	+ 5.1	5.95	+1.00	−2.00	5.9	+0.9	78	+ 1
Florida Peninsula	79.7	−1.1	− 2.8	8.74	+1.90	+8.80	7.3	+2.2	78	0
East Gulf	78.3	+0.2	− 1.5	4.06	−0.50	+5.10	6.1	+1.1	77	+ 2
West Gulf	77.0	−2.0	− 5.0	6.23	+2.50	+2.30	5.9	+1.6	79	+ 5
Ohio Valley and Tennessee	76.1	+3.1	+ 8.2	4.00	−0.20	−1.50	5.2	+0.2	72	+ 1
Lower Lakes	72.6	+5.6	+16.8	2.61	−0.90	−0.50	3.7	−1.2	69	− 2
Upper Lakes	68.4	+5.9	+23.6	2.51	−0.80	−1.50	4.1	−1.0	75	+ 2
North Dakota	68.4	+4.7	+22.7	2.34	−1.30	−0.70	3.9	−1.2	69	0
Upper Mississippi Valley	74.0	+3.1	+16.0	4.78	+0.40	−0.40	5.6	+0.6	76	+ 6
Missouri Valley	72.5	+1.6	+16.6	4.29	0.00	−1.00	5.9	+0.9	76	+ 9
Northern slope	65.8	+3.7	+17.8	1.33	−0.90	−3.00	3.5	−1.3	50	−10
Middle slope	71.2	−0.7	+ 3.9	2.85	−0.30	−2.10	4.8	+0.8	67	+ 6
Southern slope	73.1	−4.1	−10.4	2.84	+0.20	+3.50	4.8	+1.0	69	+11
Southern Plateau	74.2	−0.4	− 6.4	0.35	0.00	+0.40	1.7	−0.3	35	+ 5
Middle Plateau	67.9	+2.2	+ 7.7	0.03	−0.40	−2.20	1.3	−2.0	28	−10
Northern Plateau	64.9	0.0	+ 9.4	0.03	−1.10	−2.50	3.4	−1.1	37	−15
North Pacific	56.8	−1.5	+ 3.4	0.87	−1.10	+1.40	4.9	−1.1	72	− 4
Middle Pacific	61.6	−1.0	− 0.7	0.02	−0.40	−2.00	1.5	−1.6	59	− 5
South Pacific	68.1	+1.4	+ 4.4	0.00	−0.10	−3.80	1.2	−2.0	60	− 6

Winds of 50 mis./hr. (22.4 m./sec.) or over, during June, 1919.

Station.	Date.	Velocity.	Direction.	Station.	Date.	Velocity.	Direction.
Bismarck, N. Dak.	12	63	sw.	Mount Tamalpais, Calif.	26	66	nw.
Cairo, Ill.	8	59	sw.	Do.	27	54	nw.
Dayton, Ohio	16	50	ne.	Do.	29	56	nw.
Drexel, Nebr.	19	56	e.	Norfolk, Va.	7	67	nw.
Do.	25	50	nw.	North Head, Wash.	21	52	se.
El Paso, Tex.	13	53	ne.	Pierre, S. Dak.	26	54	ne.
Evansville, Ind.	2	67	s.	Point Reyes Light, Calif.	8	67	nw.
Kansas City, Mo.	26	50	n.	Do.	9	66	nw.
Modena, Utah	10	51	sw.	Do.	10	68	nw.
Mount Tamalpais, Calif.	8	62	nw.	Do.	11	51	nw.
Do.	9	84	nw.	Do.	16	55	nw.
Do.	10	80	nw.	Do.	17	60	nw.
Do.	13	56	nw.	Do.	18	61	nw.
Do.	14	72	nw.	Do.	19	58	nw.
Do.	15	78	nw.	Do.	25	50	nw.
Do.	16	72	nw.	Do.	27	54	nw.
Do.	17	68	nw.	Do.	28	58	nw.
Do.	18	66	nw.	Do.	29	50	nw.
Do.	19	88	nw.	St. Joseph, Mo.	26	54	nw.
Do.	20	54	nw.	St. Louis, Mo.	16	69	sw.
Do.	22	52	nw.	Williston, N. Dak.	29	60	w.
Do.	25	54	nw.				